

Extreme Weather and Infrastructure Resilience

Illinois DOT- MPO Fall Planning Conference 10/28/21

BI-STATE REGIONAL COMMISSION

FHWA PILOT PROJECT

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PLANNING DIRECTOR

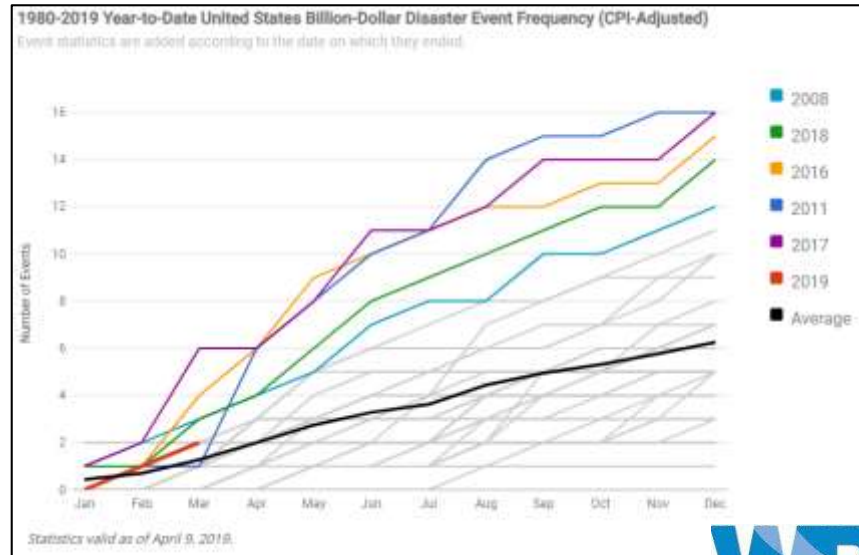


U.S. Department of Transportation
Federal Highway Administration



FHWA Resilience and Durability to Extreme Weather Pilot Program

2018 Resilience Pilots

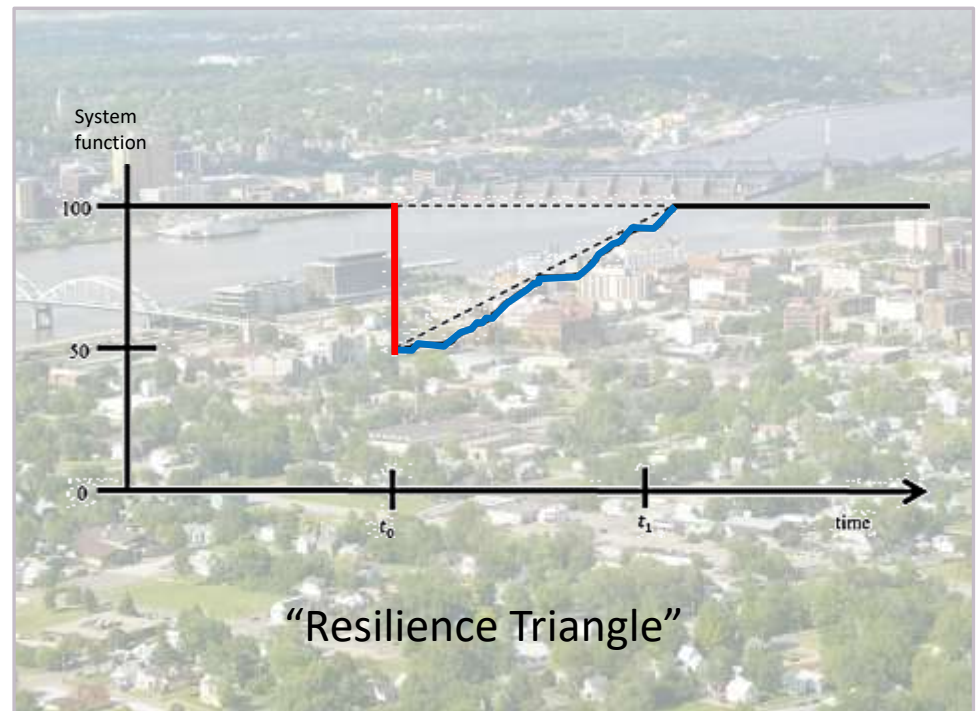


Source: National Weather Service

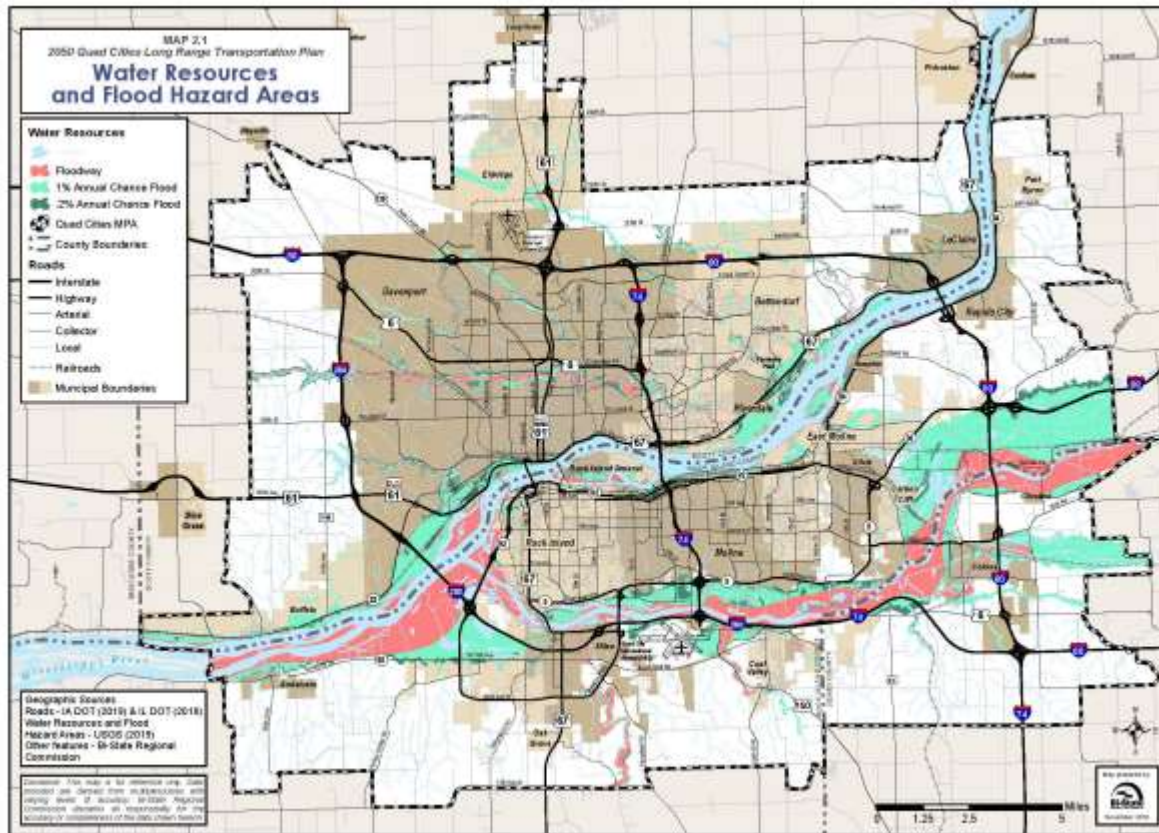


Purpose of the Grant

- Conduct vulnerability assessment
- Determine strategies to mitigate impacts



Quad Cities MPA, Iowa/Illinois



5 Mississippi River Bridges + Rock River Crossings

4 Interstates, 5 U.S. Highways, 10 State Highways

3 Railroads – Class I & II

24 Barge Terminals

2 Locks/Dams

3 Public Transit Systems + Multiple On-Demand Private Providers & Taxis Services

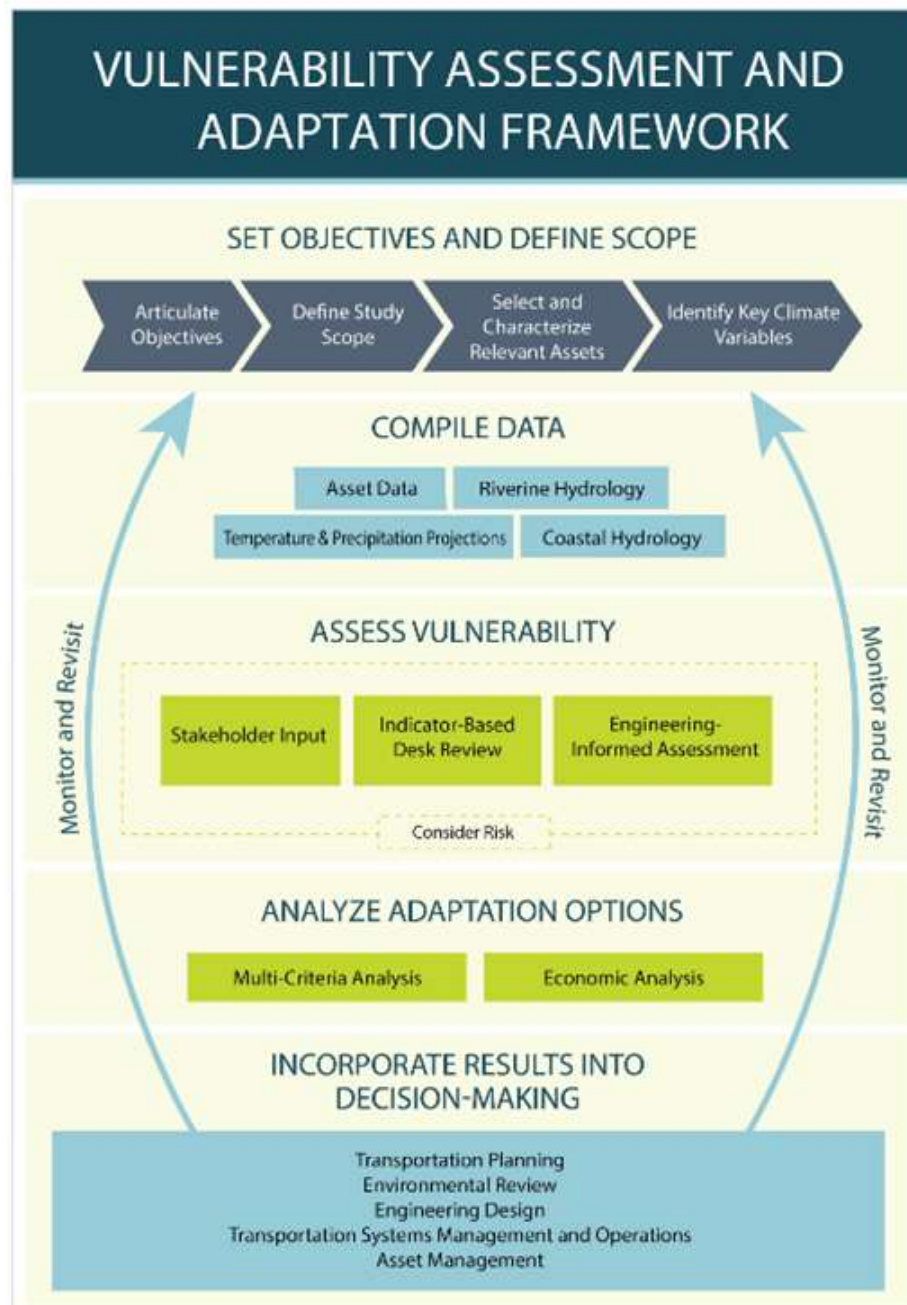
2 Airports

2 National Trails



Project framework

- Develop an Advisory Committee
- Secure data
- Access vulnerability and adaptation options
- Determine priorities and opportunities to incorporate adaptation
- Integrate assessment



Stakeholders



Environmental/Other

- NOAA-NWS, State Climatologists
- Corps of Engineers, NRCS, DNR/IEPA
- Industry, Health Depts., Universities



Transportation

- FHWA, State DOTs, County & City Engineers/Planners, EMAs
- Transit, Railroads, Airports, Trails Interests



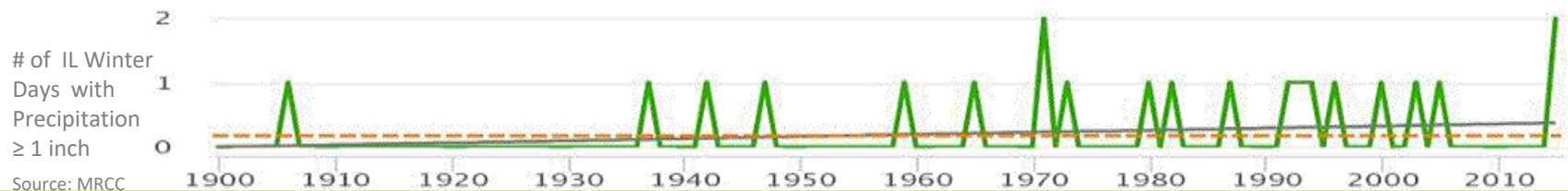
Policy and Adaptation

- Planning Advisory Group
- Transportation Technical and Policy Committees

Summary of data trends

- FEMA Flood Risk Report
- CMIP Climate Data Processing Tool
- National Climatic Data Center
- FHWA, IL DOT, IA DOT
- Midwest Regional Climate Center
- US Geological Survey
- National Weather Service

- Increased variability
 - Floods, tornadoes, storms
- Increased precipitation
 - Frequency
 - Volume
- Increased disruptions for transportation networks
 - Impacts CAN be reduced through adaptive actions

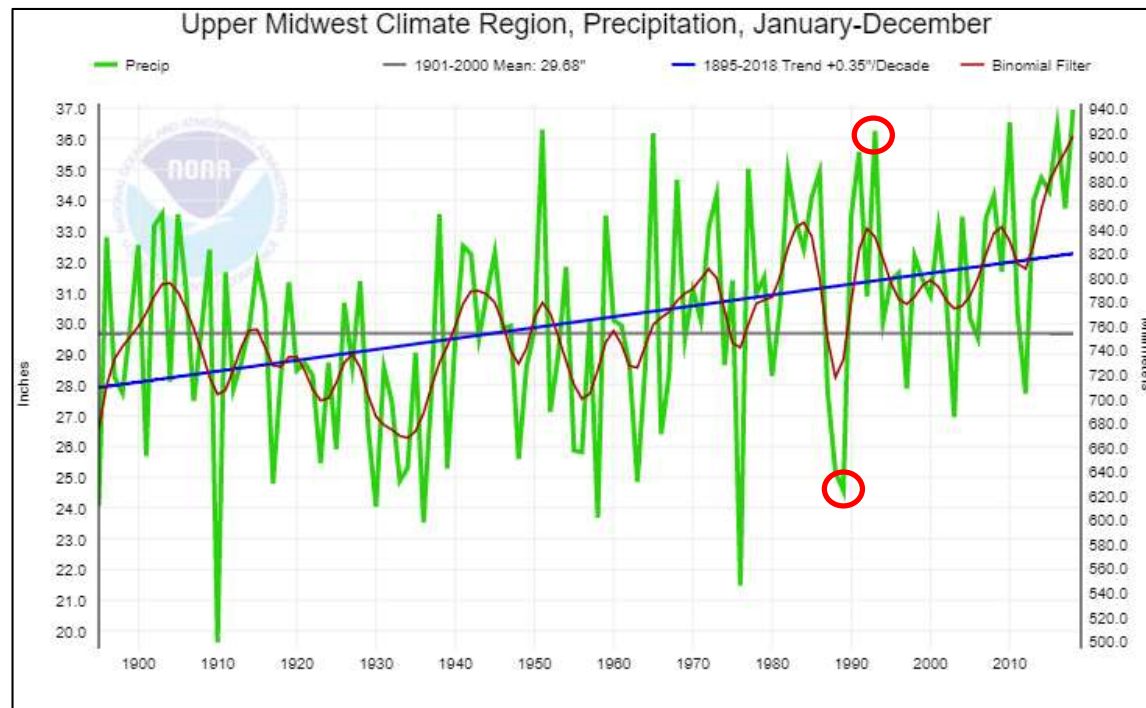


Variability vs. Trend and Extremes

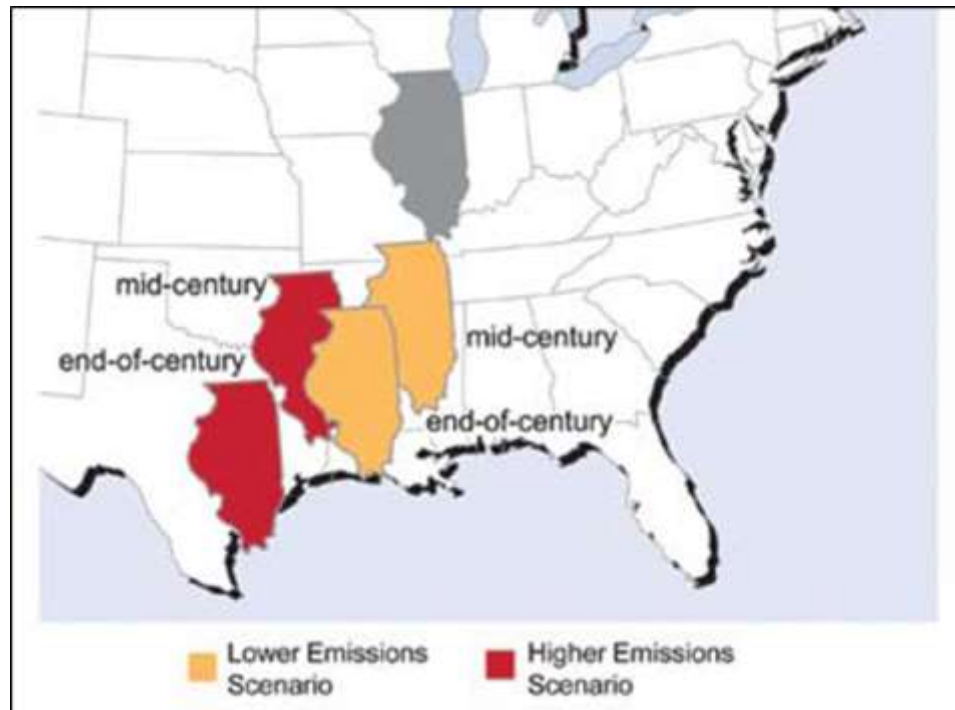
Trend

Variability

Extremes



Future Climate



Hazards today and in the future

Heat

Flood, river and flash

Drought

- Wildfires (rare)

Winter Storms

Severe weather

- Tornadoes, hail, damaging wind

Hurricanes? Coastal Flooding?

These are confounded with an increase in social vulnerability.

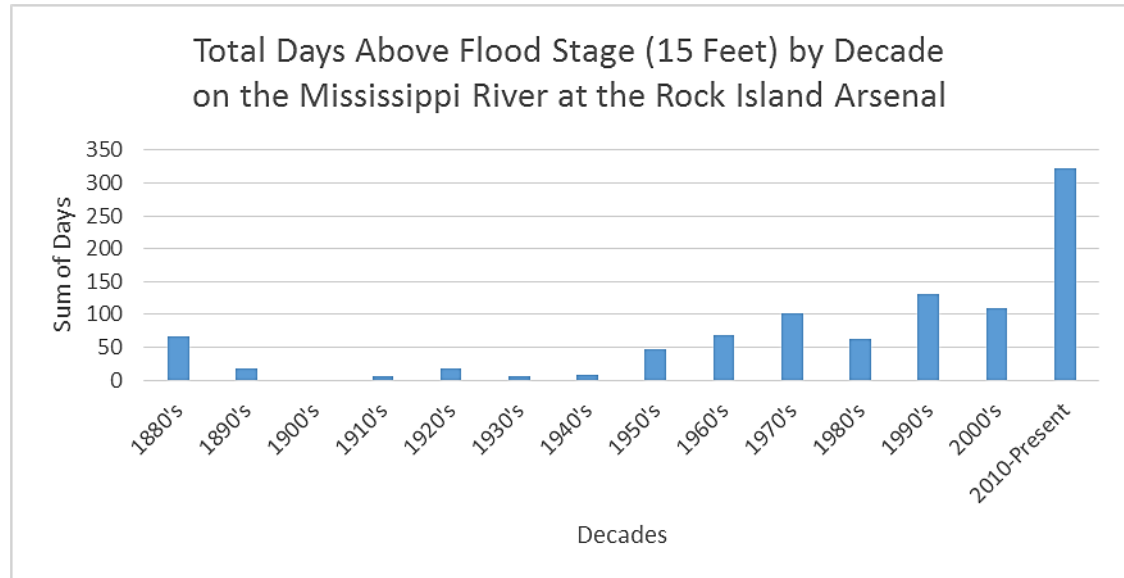


Extreme Weather in the Quad Cities

- River flooding
- Flash flooding
- Combined storms
 - Hail
 - Lightning/thunder
 - High winds
- Severe winter storm
- Extreme heat
- Tornadoes



Learning to Live With The River – 1993, 2011, 2019



Source:
Illinois (2019)

U.S. Army Corps of Engineers Mississippi River Gauge Data at Rock Island

Mississippi River Record Crests

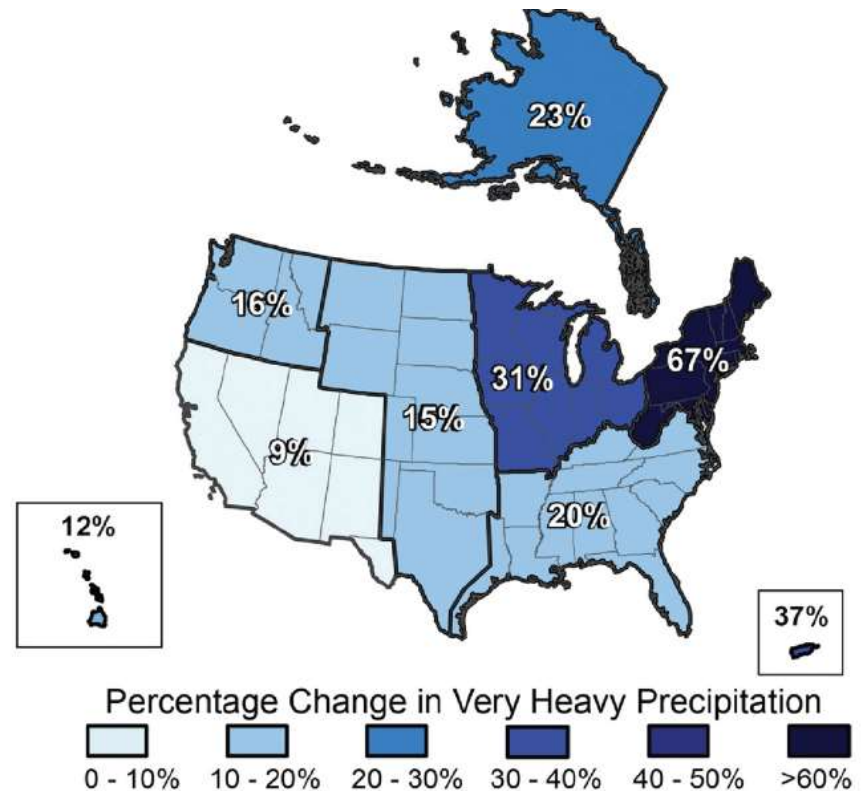
22.70 ft on 5/2/2019 1st
22.63 ft on 7/09/1993 2nd

Records for Consecutive Days above Flood Stage

96 days: 2019 – 3/15 to 6/18
43 days: 2011 – 3/29 to 5/10

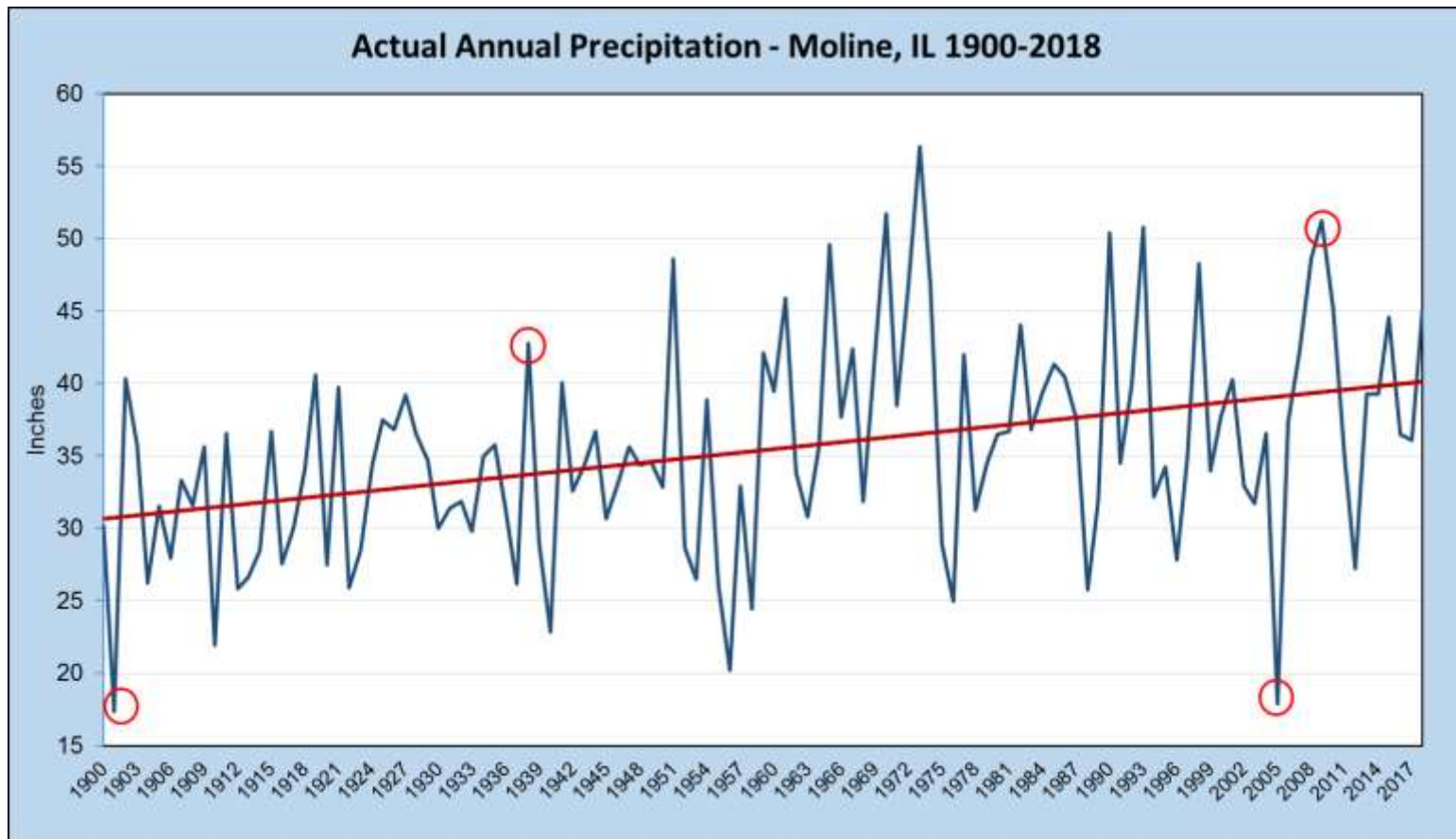
Data sharing

- City inundation data?
- Storm surge backup on the Mississippi?
- Late season floods?
- Straight line winds?
- Main routes that have underground power lines?
- Extreme heat?
- Other?



Source: Climate Change Impacts in Iowa: Report to the Governor and Assembly, 2010

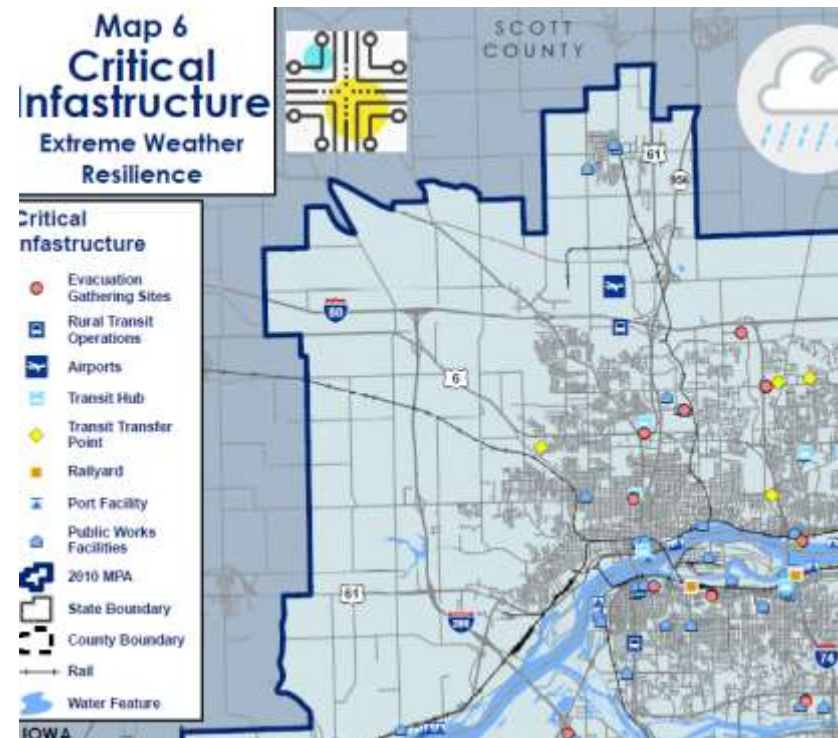
Local Trends 1900-2018



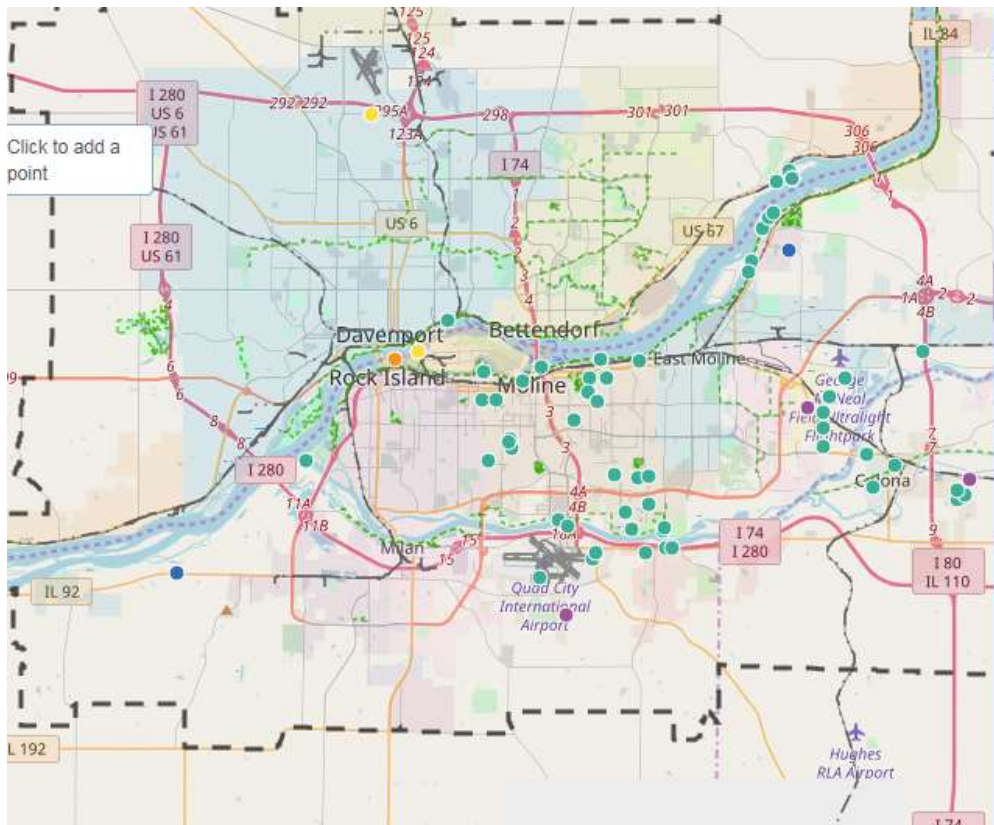
Source: National Weather Service

Critical Infrastructure & Facilities

- Evacuation gathering sites
- Public works facilities
- Transit hubs
- Transit transfer points
- Rural transit operations
- Airports
- Port facilities
- Railyard



Stakeholder Survey & Interviews



Click to add a point

Transportation Infrastructure Problems

Details

Type (required)
Select... ▼

Structural Impact

Submitted By

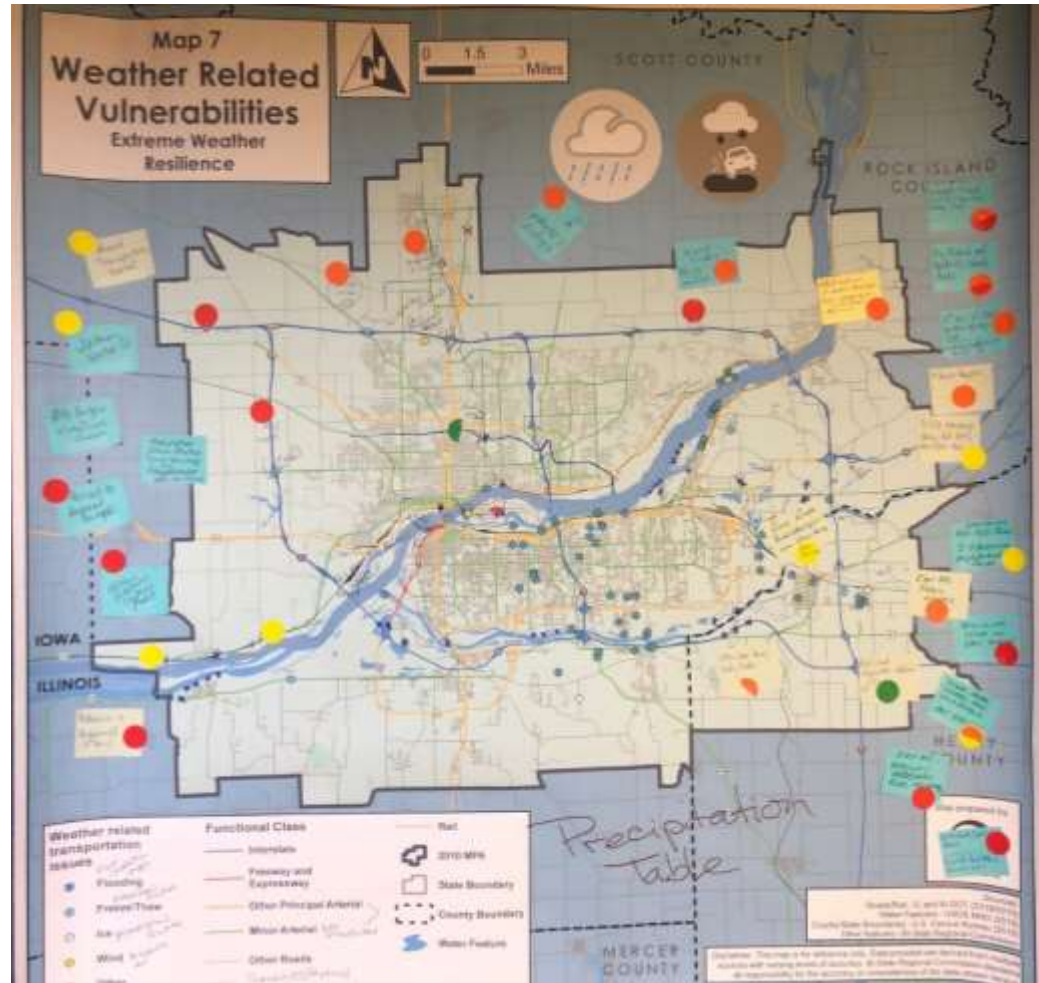
Location

Click the map to draw the location.

Enter an address to search

Stakeholder Workshop

- Vulnerability assessment
- Adaptation options



Vulnerability assessment = what critical facilities/infrastructure are more vulnerable to disruptions or likely to be impacted by extreme weather, now and in the future.

Defining Criticality Criteria

Stakeholder & Transportation Technical Committee Input

Criticality assessment
= involves identifying the most critical elements of the transportation system for analysis, using quantitative and qualitative data.

- High use areas/routes
- Land use/destinations of importance
 - i.e. RI Arsenal, densely populated areas
- Mississippi River crossings
- Medical/emergency routes
 - i.e. hospital access
- Redundancy throughout network
- Economic vitality
 - i.e. access to large employers

Data Input for Weighted Sum Criticality Overlay Analysis

Bridges (AADT)

Manual Classification

< 1,000	1
1,001 – 10,000	2
10,001 – 25,000	3
25,001 – 40,000	4
> 40,000	5
Pedestrian access bridge	1

IL Roadways (AADT)

Natural Breaks Classification

500 - 4,250	1
4,251 – 9,400	2
9,401 – 17,900	3
17,901 – 32,600	4
32,601 – 69,700	5

IA Roadways (AADT)

Natural Breaks Classification

500 - 3,520	1
3,521 – 8,900	2
8,901 – 17,100	3
17,101 – 30,000	4
30,001 – 72,000	5

Access to Critical Facilities

All access road segments 5

Access to Major Employers

All access road segments 1

Bettendorf Transit (Ridership)

Natural Breaks Classification of Avg. Weekday Ridership

0 – 76	1
77 - 95	2
96 - 111	3

Davenport Transit (Ridership)

Natural Breaks Classification of Avg. Weekday Ridership

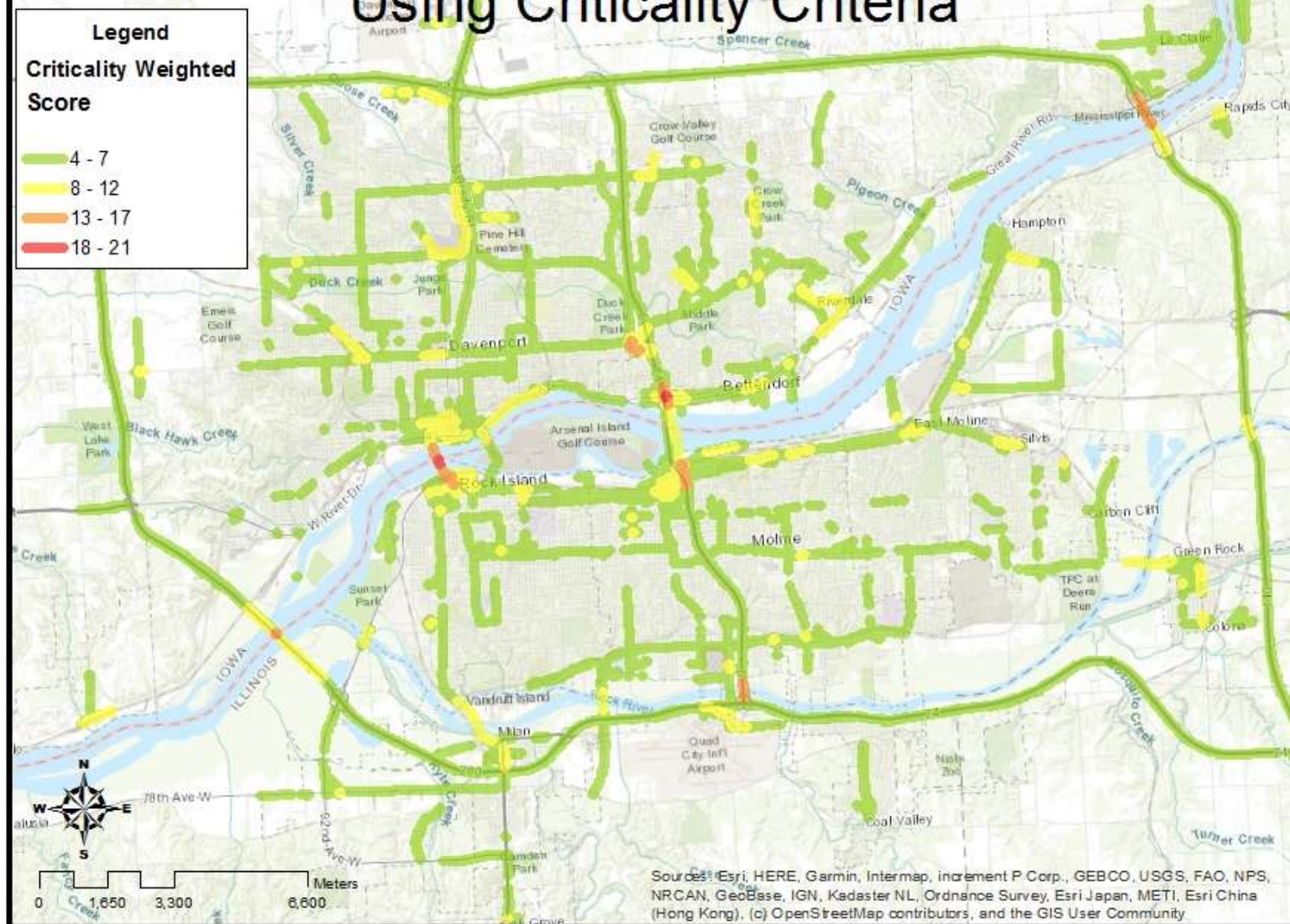
0 – 110	1
111 - 186	2
187 - 302	3

MetroLink Transit (Ridership)

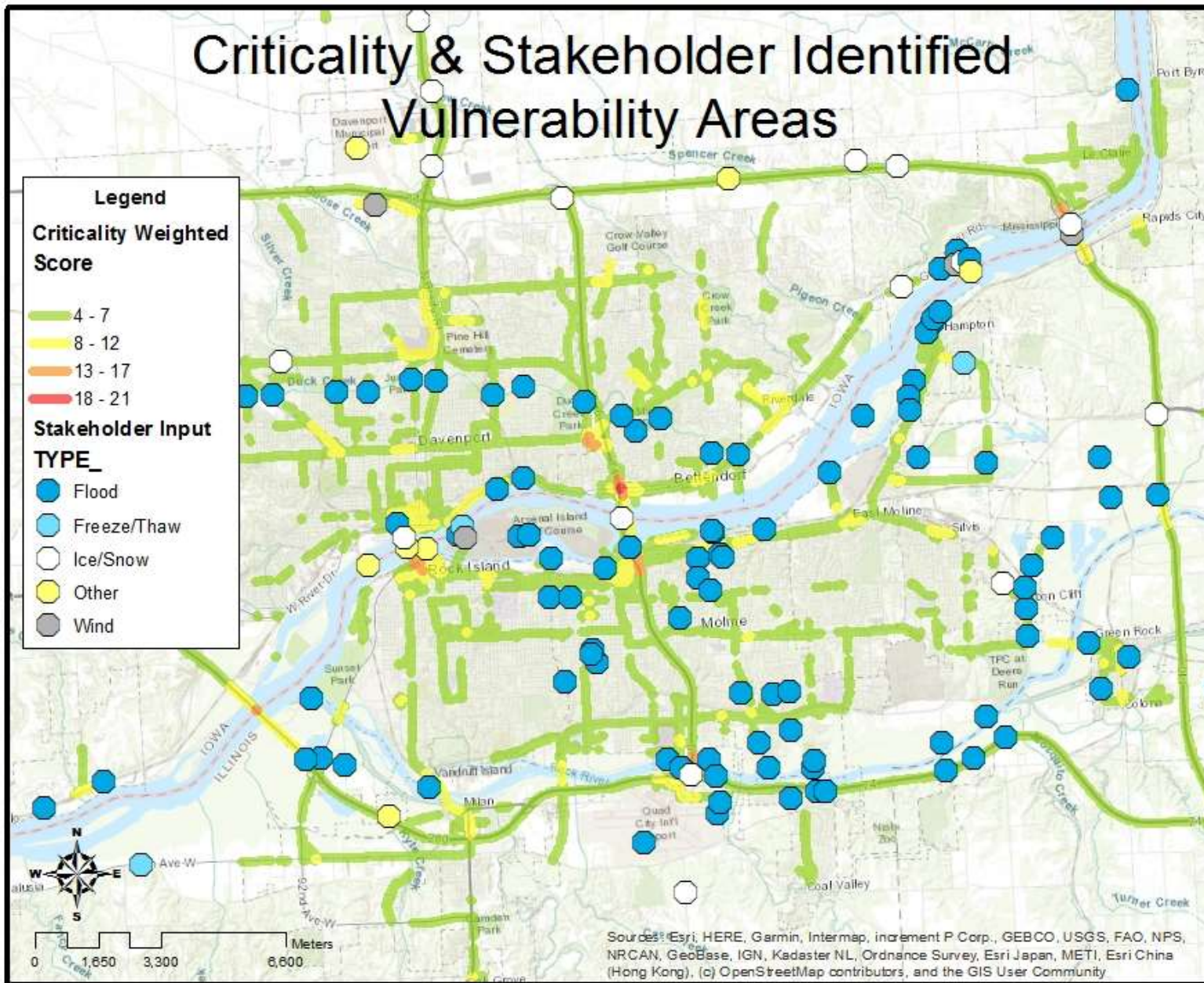
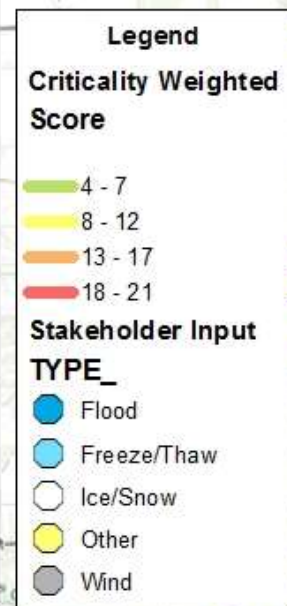
Natural Breaks Classification of Avg. Weekday Ridership

0 – 634	1
635 – 1,545	2
1,546 – 2,518	3

Result of Weighted Multi-criterion Analysis Using Criticality Criteria



Criticality & Stakeholder Identified Vulnerability Areas



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Areas Deemed both Critical and Vulnerable to Flooding

Legend
 CritRoadFloodAreas

Callouts:
 - Duck Creek crossings
 - Drainage issues and ponding
 - Creek & Rock River cause road closures
 - Potential I74 inundation
 - I280 Flooded on/off ramp

Scale: 0, 1,650, 3,300, 6,600 Meters

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geobase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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Map Labels: Davenport, Bettendorf, Rock Island, Moline, Carbon City, Green Rock, Colona, Turner Creek, Rock River, Pigeon Creek, Duck Creek, Silver Creek, Goose Creek, Spencer Creek, Great River Rd, Mississippi River, Le Claire, Rapids City, Port Byron, McCarty Creek, Crow Creek, Crow Valley Golf Course, Middle Park, Riverdale, East Moline, Silvis, TPC at Deere Run, Vandeventer Island, Milan, Quad City Int'l Airport, Camden Park, Sunset Park, West Lake Park, Emmet Golf Course, Jura Park, Aresenal Island Golf Course, W. River Dr, 78th Ave-W, 74th Ave-W.

Scale: 0, 1,650, 3,300, 6,600 Meters

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, Geobase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Focus for Adaptation Options Prioritization

- Most at-risk
 - Corridors
 - Hot spots
- Already Planned Projects
- Asset by State or Jurisdiction
- Combination

Priority Segments for Adaptation Options Review



Review Priorities by Potential Solutions

Advisory

Intelligent Transportation System (ITS)

Motorist alerts

Communication & Outreach Plan

Road side active warning systems

Control

Variable speed limits

Vehicle restrictions

Route restrictions

Road-surface treatments

Treatment

Green infrastructure

Levee construction (traditional and living)

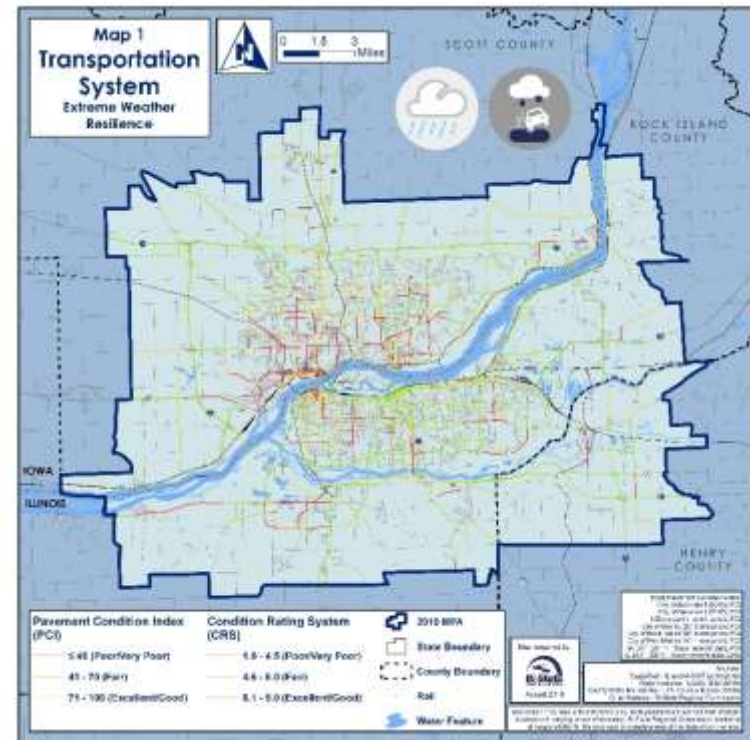
Culvert sizing

Road/bridge elevation

(Asam et. al., FHWA, 2015)

Other *Policies and Procedures*

- Climate and emissions policies
- Emergency Management
- Mitigation Measures
- Disinvestment
- Solutions with co-benefits
- Environmental Justice and Equity



Incorporating into Transportation Planning Process

L RTP

Extreme Weather Resilience Objective

- Developed objective for L RTP – policy statement
- Discussed Critical and Vulnerable Areas
- Examined resilience review for planned projects

TIP

Resilience Discussion & Project Selection

- Recognize resilience in TIP – use environmental maps to highlight vulnerabilities
- Incorporate resilience similar to EJ review as additional input prior to decisions

Technical Asst.

Resilience in Project Development Process

- Write grants for priority resilience areas
- Work with local jurisdictions during project development process to incorporate adaptation options into project development

Lessons Learned

Priorities and
Opportunities for
Adaptation

+

Integrate Results &
Recommendations

Lessons Learned – Peer Exchange

- Growing Staff Capacity in Climate
- Data Integration
- Valuing Resilience
- Proactive Collaboration
- Mainstreaming Resilience
- Resilience Informed Planning

Questions?

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